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L-11-081

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ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001**SUBJECT:**Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
Submittal of Snubber Program for Beaver Valley Power Station Unit Nos. 1 and 2

The American Society of Mechanical Engineers Operations and Maintenance (OM) Code, Subsection ISTA, "General Requirements," establishes requirements for inservice testing and examination of pumps, valves, pressure relief devices, and dynamic restraints (snubbers). ISTA-3100, "Test and Examination Program," requires preparation of test plans for these components, and ISTA-3200, "Administrative Requirements," requires the test plans to be filed with the regulatory authorities having jurisdiction at the plant site.

Inservice test plans for pumps, valves, and pressure relief devices were submitted by letters dated March 21, 2007, and May 11, 2007, for Beaver Valley Power Station (BVPS) Unit Nos. 1 and 2, respectively. The BVPS snubber test and examination program is maintained separately from the previously submitted documents. Therefore, a copy of the snubber program for BVPS Unit Nos. 1 and 2 is enclosed.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-761-6071.

Sincerely,



Paul A. Harden

Enclosure: Beaver Valley Power Station Snubber Program

cc: NRC Region I Administrator
NRC Resident Inspector Office
NRC Project Manager
Director BRP/DEP
Site Representative BRP/DEP

Enclosure to Letter L-11-081

Beaver Valley Power Station Snubber Program

(27 pages follow)

Beaver Valley Power Station

Unit 1/2

1/2-ADM-2140

SNUBBER PROGRAM

Document Owner
Manager, Technical Services Engineering

Revision Number	8
Level Of Use	In Field Reference
Safety Related Procedure	Yes
Effective Date	05/19/11

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1.0 PURPOSE

1.1 The intent of the Snubber Program is to demonstrate and ensure snubber operational readiness through periodic examinations, testing, and service life monitoring. The purpose of this document is to establish the requirements for the visual examinations, testing and service life monitoring of snubbers at BVPS Unit #1 and Unit #2.

2.0 SCOPE

2.1 The Snubber Program includes all snubbers installed at Unit 1 and Unit 2. These are identified in the appropriate Unit's Snubber Plans located in the Snubber Program Notebook. The Snubber Plans are further subdivided into "safety-related" snubbers and "non-nuclear safety" (balance of plant) snubbers.

2.2 The original scope of this program was based on the following documents"

 2.2.1 Unit 1: Engineering Specification No. 8700-DMS-113.

 2.2.2 Unit 2: Engineering Memorandum No. 90321.

2.3 Regulatory Bases:

 2.3.1 Unit 1 Licensing Requirement Manual, Section 3.7.4, "Snubbers."

 2.3.2 Unit 2 Licensing Requirement Manual, Section 3.7.4, "Snubbers."

 2.3.3 ASME Code for Operation and Maintenance of Nuclear Power Plants, 2001 Edition up through the 2003 Addenda.

 2.3.4 ASME Boiler and Pressure Vessel Code, Section XI, (BVPS Code of Record), Paragraphs IWA-2213 and IWA-4132.

 2.3.5 Beaver Valley Power Station Improved Standard Technical Specifications, Limiting Condition for Operation, LCO 3.0.8.

 2.3.6 Code of Federal Regulations, 10CFR 50.55a, "Codes and Standards," Paragraph (b)(3)(v)

3.0 REFERENCES AND COMMITMENTS

3.1 Condition Report, CR 02-09656 (Corrective Action, CA 02-09656-1) – PSA Snubber Trending Requirements

3.2 Condition Report, CR 04-08479 (Corrective Action, CA-04-08479-01) – QA Audit Items.

3.3 Condition Report, CR 05-05161 (Corrective Action, CA-05-05161-02) – Actions for Low Snubber Reservoir Levels.

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3.4

Condition Report CR-05-07570 (Snubber Program Compliance to ASME Section XI, IWF-5000).

3.5

Condition Report CR 08-51447 (BV Snapshot Self-Assessment BV-SA-8-093 – Noteworthy Item).

3.6

Engineering Memorandum,

EM 90226, (Non-Safety Related Snubbers)

EM 90321, (Original Unit 2 Snubber List)

3.7

NOP-ER-3203, "Snubber Program"

3.8

NOP-LP-2001, "Condition Report Process."

3.9

NOP-ER-2101, "Engineering Program Management."

3.10

NOP-SS-3001, "Procedure Review and Approval."

3.11

NORM-ER-3211, "Supports – Snubbers."

3.12

NRC Information Notice 94-48, Dated 6/30/94, "Snubber Lubricant Degradation in High-Temperature Environments".

3.13

Self-Assessment, BV-SA-02-41, "BV Snubber Program Effectiveness in Controlling Dry Lubricant in PSA Snubbers," Dated 10/31/02.

3.14

Self-Assessment, BV-SA-05-150, "Comparison of the BVPS Snubber Program to the INPO Engineering Program Excellence Guide," Dated 11/22/05

3.15

Self-Assessment, BV-SA-08-093, "The Effectiveness of the Current Maintenance Strategy for PSA Mechanical Snubbers at BV," Dated 12/30/08.

4.0

RECORDS AND FORMS

4.1

Records

4.1.1

QA Records: Snubber Examination Checklist (ATTACHMENT A) and the snubber service vendor's final report (Paragraph 4.1.2) will be processed as "lifetime" Quality Assurance records in accordance with NOP-SS-3300, "FirstEnergy Enterprise Records Management Programs." Both records shall be transferred to the BVRC for processing within 90 days of completion.

4.1.2

Vendor Documentation: Upon completion of a contracted service, the contracted vendor shall submit to the SEPO, as a minimum, two copies of a final report, one of which preferably containing all the original documentation. Distribution of the report shall be, as a minimum, to the SEPO (original) and QA Records. The report shall include, but not be limited to, the following:

4.1.2.1

All records and reports generated, including those identifying non-conformances.

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<p>4.1.2.2 Calibration data for the testing equipment.</p> <p>4.1.2.3 Equipment certification.</p> <p>4.1.2.4 Personnel certifications.</p> <p>4.1.2.5 All vendor procedures used to perform the contracted service.</p> <p>4.1.2.6 Signatures of contracted personnel who performed or evaluated examinations or tests.</p> <p>4.2 <u>Forms</u></p> <p>4.2.1 None</p> <p>5.0 <u>DEFINITIONS</u></p> <p>5.1 Anomaly - A deviation from the normal or expected condition.</p> <p>5.2 Inaccessible Snubbers - Snubbers that are in an area that would expose plant personnel to undue hazards during normal plant operating conditions.</p> <p>5.3 Inoperable Snubber - A snubber that cannot perform its specific function, i.e., it either cannot restrain or move when required.</p> <p>5.4 Operational Readiness - The ability of a snubber to perform its specified function.</p> <p>5.5 Safety-Related Snubbers - Snubbers installed on safety-related systems and on non-safety related systems which are "important to safety", i.e., systems whose failure or the failure of an installed snubber would adversely effect any safety-related systems. (See EM 90226 for definition.)</p> <p>5.6 Snubber - A hydraulic or mechanical device whose specific function is to restrain a component or a system during a sudden application of abnormal forces, such as, an earthquake or water hammer, but also to allow unrestricted movement of the component or system during thermal expansion and contraction.</p> <p>5.7 <u>Unacceptable Snubber</u> - A snubber that does not meet examination or testing requirements.</p>			

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6.0 RESPONSIBILITIES

6.1 Snubber Site Engineering Program Owner (Snubber SEPO): The Snubber SEPO is responsible for Snubber Program implementation at the site. As a minimum training requirement, the Snubber SEPO (and the Backup Snubber SEPO) shall be qualified as the Snubber Site Engineering Program Owner in FITS. The core responsibilities of the Snubber SEPO are, but not limited to, the following:

6.1.1 Prepares and implements snubber administration and technical procedures, including the establishment of snubber inspection, test and service life criteria.

6.1.2 Plans, schedules and performs snubber inspection, testing, and maintenance activities and ensures that these activities are conducted in accordance with regulatory requirements.

6.1.3 Solicits and controls funding for snubber activities.

6.1.4 Solicits, procures and coordinates contracted snubber services.

6.1.5 Investigates and resolves nonconforming snubbers or related activities, initiating any corrective action, as necessary.

6.1.6 Trends degraded conditions for further deterioration.

6.1.7 Monitors the service life of all snubbers and initiates snubber refurbishment or replacement prior to the expiration of the service life.

6.1.8 Creates and maintains computer data management systems for program tracking and control.

6.1.9 Reports site program health to management through the use of periodic meaningful performance indicators and quarterly program health reports.

6.1.10 Maintains awareness of industry Operating Experience and utilize Operating Experience to improve program effectiveness.

6.1.11 Maintains the Site Program Notebook.

6.1.12 Participate with the Snubber User Group (SNUG) to stay current with industry issues, trends and best practices.

6.1.13 Ensures site program documents and implementing procedures are clear and current with industry best practices as determined by the FENOC Program Manager

6.2 ISI Site Engineering Program Owner (ISI SEPO): The ISI SEPO shall be responsible for the visual examination of the snubber's attachments from the pressure boundary surface to the building structure. These examinations will be conducted in accordance with the ISI Program.

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<p>6.3 Site Organizational Roles and Responsibilities: For the roles, responsibilities and interfaces of other site organizations and individuals related to snubber activities see the Organization and Responsibilities section in NOP-ER-3203, "Snubber Program."</p> <p>7.0 <u>PROCEDURE</u></p> <p>7.1 Safety-Related Snubbers: All safety-related snubbers shall undergo the following activities:</p> <p>7.1.1 Visual examination per Section 7.7</p> <p>7.1.2 Functional testing per Section 7.8</p> <p>7.1.3 Service life monitoring per Section 7.9</p> <p>7.1.4 For the deferral of the above tasks an engineering review and justification is required</p> <p>7.2 BOP Snubbers: On a best effort basis, non-nuclear safety (balance of plant) snubbers should follow the service life monitoring requirements of Section 7.9</p> <p>7.3 Personnel and Procedures: Examination, testing, and maintenance activities as required by this program may be performed by either qualified plant or contracted personnel using either plant or approved vendor procedures. The procedures prepared by a procured vendor will be approved for use in accordance with NOP-SS-3001, "Procedure Review and Approval".</p> <p>7.4 Inoperable Snubber: For every safety-related and BOP snubber found inoperable, the following requirements shall be performed:</p> <p>7.4.1 <u>Station Notification:</u> The Snubber SEPO shall notify the appropriate management personnel through the condition report process.</p> <p>7.4.2 <u>LCO 3.0.8:</u> Technical Specifications, Limiting Condition of Operations, LCO 3.0.8, shall be reviewed for applicability.</p> <p>7.4.3 <u>Snubber Restoration:</u> The inoperable snubber must be restored through repair or replacement to operable status. The restoration must be performed within the completion time identified in the Licensing Requirements Manual or within 72 hours if the supported component or system is required to be operable during the current mode of plant operation.</p> <p>7.4.4 <u>Engineering Evaluation:</u> An engineering evaluation shall be performed on the components, which are supported by the inoperable snubber to ensure that the components were not adversely affected by the inoperable snubber and remain capable of intended service. The evaluation must be performed within the completion time identified in the Licensing Requirements Manual or within 72 hours if the supported component or system is required to be operable during the current mode of plant operation.</p>			

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<p>7.4.5 Determination of Cause: An investigation shall be performed to determine the cause for snubber unacceptability. If the cause is determined to be a generic deficiency, then all snubbers of the same design subject to the same defect must be assessed for operational readiness.</p> <p>7.4.6 Retest: An inoperable snubber which was repaired or replaced shall be "as-found" functionally tested during the next test period unless the cause of the failure is clearly established and corrected. Retests will be conducted in accordance with the test parameters and criteria of paragraph 7.8.3, but the snubber will not be a part of the selected test sample nor require additional testing should it fail.</p> <p>7.5 Transient Dynamic Event: If a transient dynamic event (e.g., water hammer, steam hammer) occurs that may affect snubber operational readiness, then the affected snubbers and systems shall be reviewed and appropriate corrective action taken.</p> <p>7.6 On-Line Snubber Removal: No safety-related or BOP snubber shall be removed from an operating system for any surveillance activity described in this program without an engineering evaluation for effects on the system. No more than one snubber can be removed at the same time for that portion of the operating system.</p> <p>7.7 Visual Examination Requirements: Snubbers shall be visually examined periodically to the requirements below to identify any physical, operating or environmental condition that could prohibit a snubber from performing its specified function.</p> <p>7.7.1 Qualification: Personnel performing the visual examination shall be qualified in accordance with Subsection IWA-2300 of the ASME Section XI Code or with Attachment B of NOP-ER-3203.</p> <p>7.7.2 Examination Instructions: All visual examinations listed below shall be conducted and documented in accordance with the instructions identified on the Snubber Visual Examination Checklist (ATTACHMENT A) or with an approved equivalent procedure.</p> <p>7.7.3 Preservice Examination: Prior to system startup, snubbers shall be visually examined following snubber installation or a field repair to correct an anomaly that rendered the snubber as "unacceptable."</p> <p>7.7.4 Inservice Examination: Installed snubbers shall be periodically examined in their "as-found" condition. They shall not be removed, adjusted, maintained or repaired prior to an examination specifically to meet the examination criteria.</p> <p>7.7.5 Inservice Examination Categorization: For each unit, snubbers may be examined as ONE population, regardless of type, or as accessible and inaccessible. The determination must be documented prior to and maintained throughout surveillance window.</p>			

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7.7.6 Inservice Examination Intervals: The examination interval for each category shall have a frequency and duration determined by TABLE ISTD-4252-1. For establishing the next examination interval, the end of the current period is defined as the date that the last inservice visual examination for that particular exam group was completed. (For the current examination category and interval, see the Snubber Surveillance Dates section of the Snubber Program Notebook.).

7.7.7 Pre-Removal Examination: All installed snubbers will be visually examined in its “as-found” condition prior to removal. This examination may take credit as the required inservice examination during the inservice surveillance window.

7.7.8 Examination Assessment: The Snubber SEPO will review the examination results to ensure the completion of all exams and to determine the acceptability of the examination. Snubbers with reportable anomalies will be evaluated to see if they can perform their specified functions. After assessment, snubbers with the following conditions shall be considered unacceptable.

- Incapable of restraining movement when activated.
- Restricted thermal movement to the extent that unacceptable stresses could develop in the snubber or the pipe/component.

7.7.9 Unacceptable Snubbers: Each unacceptable snubber shall be declared inoperable and the requirements of Section 7.4 shall be performed.

7.7.10 Evaluation by Testing: If relevant to the anomaly, a snubber that requires further evaluation or has been classified as unacceptable by inservice examination may be reclassified as acceptable by successfully completing an as-found functional test as described in Section 7.8 below. If testing for insufficient fluid content, the test for Grinnell and Lisega snubbers will start in the direction that corresponds to its next thermal movement direction. Otherwise, the test will start in the tension direction.

7.7.11 Anomaly Resolution: Snubbers with anomalies must be restored through corrective or preventive maintenance to acceptable standards or justified that the condition is acceptable and does not affect the operational readiness of the snubber.

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7.7.12 Low Reservoir Levels: The presence of fluid at the outlet port of a reservoir for a hydraulic snubber indicates that the snubber has sufficient fluid within its cylinder and locking/restraining mechanism to restrain dynamic piping movement upon demand. However, snubbers with fluid levels that are less than 50% full, although fully capable of restraining dynamic movement, should be restored to optimum levels to ensure reliability during the current fuel cycle. Therefore, for snubbers with fluid levels below 50% (1/4" from the red caution tag on Paul-Munroe 2000 series pipe snubbers), the Snubber SEPO shall generate a condition report to assess the snubber's ability to maintain the minimum amount of fluid throughout the remainder of the current fuel cycle. Should the assessment determine that the minimum fluid level cannot be maintained, then the Snubber SEPO shall generate a notification to restore the reservoir to above 50% and to repair/replace the snubber as necessary. Should a snubber be found with a reservoir level below 50% during a refueling outage, then the snubber may be added to the work scope of the generic order established for minor field repairs, but a condition report shall also be generated.

7.8 **Testing Requirements**: Snubbers shall be periodically tested to the requirements below to demonstrate snubber operational readiness.

7.8.1 Personnel and Equipment: Snubber testing will be performed using FENOC approved test methods, equipment and procedures. Vendor personnel shall be qualified and their equipment calibrated in accordance with the vendor's quality assurance program approved by FENOC. Test equipment shall have the range and accuracy to meet the test parameters and criteria identified on the attached Snubber Test Tables (ATTACHMENT B).

7.8.2 Test Method: Snubbers may be tested at their installed location or on a test bench. However, should the snubber size, test equipment limitations, or inaccessibility prevent the use of these methods, then the snubber subcomponents that control the parameters to be verified may be removed and tested. When test methods measure parameters indirectly or other than those specified, the results shall be correlated with specified parameters through established methods. The method shall ensure that the test results are repeatable.

7.8.3 Test Parameters and Criteria: All snubber testing identified below shall be performed in accordance with the test parameters and criteria identified in the snubber test tables, TABLE-1 through 5 (ATTACHMENT B). Snubbers whose test results fall outside of the criteria shall be considered unacceptable. Each unacceptable snubber shall be declared inoperable and the requirements of Section 7.4 shall be performed.

7.8.4 Test Loads: Snubbers shall be tested at a load sufficient to verify the required parameters. However, testing at less than rated load must be correlated to rated load.

7.8.5 Test Correction Factors: When differences between the installed operating conditions and the test conditions are recognized, correction factors shall be established and test results correlated to the operating conditions, as appropriate.

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7.8.6 Preservice Testing: All snubbers shall be tested prior to field installation to demonstrate operational readiness. The test may be performed anytime prior to installation provided that the following conditions are met. Otherwise, the snubber must be retested.

- FENOC possesses traceable documentation of the test.
- The snubber has not been in service nor reworked since the test.
- The snubber has been stored, transported and handled properly.

7.8.7 Inservice Testing: During every fuel cycle a representative sample selected by the SEPO from each defined test plan group (DTPG) shall be tested to demonstrate operational readiness. Testing can begin no earlier than 60 days before a scheduled refueling outage and shall be completed prior to the conclusion of the refueling outage.

7.8.7.1 Defined Test Plan Group (DTPG): Snubbers shall be organized into test groups from which samples will be selected for testing. Snubbers may be grouped according to differences in design, application, size or type or a combination thereof. Each snubber in a parallel or multiple installation shall be identified and counted individually. Snubbers attached to the steam generators shall be at least one, separate DPTG. Exempted from the groups for the concurrent test period are replacement snubbers and snubbers which have been repaired or adjusted as a result of unacceptable inservice examination. (For the current Defined Test Plan Groups, see the Snubber Surveillance Dates section of the Snubber Program Notebook.)

7.8.7.2 Inservice Test Sample: Test sample selection shall use the 10% Sample Plan method where the size of the initial test sample selected from each DTPG shall be 10% of the DTPG's total population rounded up to the next integer. As practical, the sample shall be a representative composite of the various differences within the DTPG and shall be selected from previously untested snubbers. Snubbers may also be selected from snubbers scheduled for a service life monitoring activity, such as, seal replacement. Aside from the above requirements, the selection shall be random. The test samples shall be selected before testing begins and used throughout the test period.

7.8.7.3 Inservice Test Restrictions: Snubbers shall be tested in their as-found condition regarding the parameters to be tested to the fullest extent practical. Test methods shall not alter the condition of a snubber to the extent that the results do not represent the as-found condition. Snubbers shall not be adjusted or repaired specifically to meet the test requirements.

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7.8.7.4 Safety Precautions: For the safety of the test personnel and test machine and to prevent further damage to the snubber, the following precautions should be observed.

- Snubbers suspected of not being able to move should be slowly stroked either by hand or at a reduced velocity and load by the test machine to ensure movement prior to the test.
- Hydraulic snubbers suspected of having a low fluid content within the cylinder should be tested at a reduced ramp rate during the activation (lockup) test.

7.8.7.5 Failure Mode Groups (FMG): Snubbers found unacceptable by inservice testing shall be evaluated for cause. The results of the evaluation shall be used to assign the unacceptable snubbers and all snubbers generically susceptible to the same failure to one or more of the Failure Mode Groups (FMG) defined in TABLE-6 (ATTACHMENT B). The intent of the FMG's is to bound the cause of failure and to determine the extent of it through additional testing of snubbers selected from the FMG.

7.8.7.6 Additional Inservice Testing: For every unacceptable snubber, additional inservice testing may be required depending on the type of failure and the extent of corrective action. Additional testing shall be performed in accordance with TABLE-6 (ATTACHMENT B) requirements.

7.8.7.7 Retest of Previously Unacceptable Snubbers: Any snubber that was repaired or replaced as a result of an unacceptable inservice test shall undergo an inservice test during the next fuel cycle unless the cause of the failure has been clearly established and corrected. The retest shall not be included in any test sample.

7.8.8 Post Maintenance Testing (As-Left Test): Snubbers which were disassembled for repair or reconditioning must be, following re-assembly, tested in accordance with the attached Snubber Test Tables (ATTACHMENT B) to ensure proper re-assembly. As applicable, this test may be used to satisfy the preservice testing requirements described above.

7.8.9 Corrective Action: Unacceptable snubbers must be restored through adjustment, repair or replacement to acceptable standards or justified that the unacceptable condition is acceptable and does not affect the functional ability of the snubber.

7.9 **Service Life Monitoring:** Snubbers shall be monitored to ensure that service time restrictions for snubbers or their critical parts are not exceeded during a period when the snubbers are required to be operationally ready.

7.9.1 Service Life Review: Prior to a refueling outage, the Snubber SEPO will review the snubber population for snubber service life expirations. If a snubber service life will be expiring between the upcoming outage and the following refueling outage, then the snubber must be reconditioned, replaced, or re-evaluated to extend its service life beyond the subsequent outage.

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7.9.2 Service Life: A snubber's service life will be defined by the limiting attributes established in TABLE-7 (ATTACHMENT C).

7.9.3 Shelf Life: The shelf life or the time spent in storage for an assembled snubber shall be factored into the snubber service life. The shelf life or the time spent in storage for uninstalled replacement seals and fluid are defined in TABLE-7 (ATTACHMENT C). Replacement seals that have exceeded their shelf life shall not be used. Replacement SF1154 fluid that has exceeded its shelf life may be used provided it meets the sampling requirements described in TABLE-8 (ATTACHMENT D)

7.9.4 Testing For Service Life Monitoring: If testing is conducted specifically for service life monitoring purposes, the results of such testing do not require testing of additional snubbers in accordance with Section 7.8.7.6, but shall be evaluated for appropriated corrective action.

7.9.5 Root Causes: Root causes resulting from examination or testing failures shall be considered in establishing or re-establishing service life.

7.9.6 Trending PSA Snubbers For Internal Degradation:

7.9.6.1 During the removal of PSA snubbers, the snubber paddles, mounting brackets, pins and fasteners shall be inspected for any evidence of vibration induced wear.

7.9.6.2 During the routine re-lubrication of PSA snubbers, while the snubbers are disassembled, the internal surfaces and mechanisms shall be inspected for any evidence of dried lubricant, fretting corrosion or other vibration induced wear.

7.9.6.3 During root cause analyses, it shall be determined whether dried lubricant related failures are attributed to elevated temperature, fretting corrosion or other vibrational induced wear.

7.9.6.4 For snubber locations where dried lubricant, fretting corrosion or other vibration induced wear has been documented, the snubber drag test results shall be trended and the service life frequency adjusted accordingly.

7.9.7 Additional Monitoring Requirements for B-P Snubbers: When testing Bergen-Paterson snubbers without applying a load to the piston, the following monitoring activities shall be conducted for the B-P snubber selected for testing.

7.9.7.1 Sample the fluid from the snubber's cylinder and reservoir and monitor for particulate, viscosity and moisture content in accordance with TABLE 8 (ATTACHMENT D).

7.9.7.2 Using only the static head pressure from the reservoir, monitor and trend the selected snubber for leakage from the piston rod seals and the cylinder seals.

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<p>7.9.8 <u>Corrective Action:</u> Degraded snubbers must be restored through adjustment, repair or replacement to acceptable standards or justified that the unacceptable condition is acceptable and does not affect the functional ability of the snubber.</p> <p>7.9.9 <u>NIS-2 Forms:</u> The submission of NIS-2 forms is required for each replacement snubber installed on components/piping within the ASME Section XI boundary. However, a NIS-2 form is not required if the replacement snubber is from rotated, previously used stock and all the requirements in ASME Section XI, Paragraph IWA-4132 are satisfied.</p>			
<p>8.0 <u>SCOPE OF REVISION</u></p>			
<p>8.1 Revision 0: This revision changed Inservice Inspection Engineering program procedure, SNUB-1, Revision 3, "Snubber Inservice Inspection (ISI) Program - General Requirements", to an ADM procedure for the purpose of complying to the new standard procedure format as required by 1/2-ADM-0100, "Procedure Writer's Guide". This revision wholly incorporated and, thereby, superseded the requirements of SNUB-1, Revision 3. The only changes made were updates to current references.</p>			
<p>8.2 Revision 1: This revision added on-line snubber removal precaution as required by Corrective Action CA-00-3094-1. It also changed the title of the ISI Coordinator to the Program Manager.</p>			
<p>8.3 Revision 2: This revision changed the snubber removal precaution of Paragraph 7.8 to permit the removal of BOP snubbers from operating systems without an engineering evaluation.</p>			
<p>8.4 Revision 3: This revision updated references and made editorial changes as identified in CA 02-07480-1, CA 02-07480-2 and CA 03-10404-1. It also updated the ASME OM Code year to the latest approved by the NRC (1998 Edition up through the 2000 Addenda) and identified the specific method for informing the NRC of the implementation of the OM Code for the governance of the Snubber IST Program.</p>			
<p>8.5 Revision 4: Incorporated changes for ITS Conversion Project (CR 05-03307 and PAF 07-02972)</p>			
<p>8.6 Revision 5: This revision was a major rewrite of the BV Snubber Program. It consolidated the four Snubber Program documents, 1/2-ADM -2140 (general requirements), 1/2-ADM-2141 (snubber visual examination), 1/2-ADM -2142 (snubber testing) and 1/2-ADM -2143 (service life monitoring), into one document to make it consistent with other site programs. It incorporated changes resulting from the adoption of the snubber surveillance requirements described in the ASME OM Code, 2001 Edition up though and including the 2003 Addenda in lieu of the current surveillance requirements identified the Licensing Requirements Manual (LRM revisions CNF 1-092 and 2-074). The revision also made 18 program enhancements as recommended by the Self Assessment, BV-SA-05-150 and the four editorial changes as recommended by a Nuclear Oversight audit documented in Condition Report CR 04-08479 (CA-01). The specific changes are described in the PAF.</p>			

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<p>8.7 Revision 6: This revision added remote examination requirements to ATTACHMENT A for B-P snubbers. It also removed the thermal as-found test criteria for Grinnell snubbers in TABLE-2 of ATTACHMENT B which was introduced in error in Revision 5. The revision changed the bleed rate test criteria for Lisega snubbers in TABLE-3 of ATTACHMENT B to the manufacturer's limits. It adjusted the service life for Basic-PSA snubber in accordance with self-assessment BV-SA-08-093. It increased the refurbishment frequency from 10 to 6 years for the Unit1 BOP snubber, SHP-HSS-236 based on the snubber's 1R18 leakage (ATTACHMENT C, TABLE-7, Note 6). It modified the 10% criteria in TABLE-8 of ATTACHMENT D, since a percentage cannot be applied to a NAS class. It also made the following administrative/editorial changes:</p> <p>8.7.1 Changed "Snubber Lists" to "Snubber Plans" in paragraph 2.1 to match Notebook terminology.</p> <p>8.7.2 Removed "Pending Approval..." from paragraphs 2.3.5, 2.3.6, 3.6 and 6.3, since the LAR's and the Snubber Program NOP have been approved.</p> <p>8.7.3 Corrected the revision number and the two "Date Closed" boxes on ATTACHMENT A.</p> <p>8.7.4 Corrected the format to the reference numbers in the "Reference" column in TABLE-7 in ATTACHMENT C.</p> <p>8.7.5 Added references for CR 08-51447 (3.5), Norm-ER-3211 (3.11) and BV-SA-08-093 (3.15).</p> <p>8.8 Revision 7: This revision removed the alternative method in Attribute 3 of the Snubber Visual Examination Checklist (Attachment A) for verifying the integrity of the load pin connecting the Bergen-Paterson snubbers to the steam generators without removing the covering insulation. To Table 7 of Attachment C, this revision added SF-N as an alternative fluid for Grinnell snubbers, extended the seal life for Lisega snubbers per EER Notification 600600020 and reduced the service life for FLOC's 2MSS-PSSP270A and 270B based on dried-grease monitoring. Also, Functional Location, 2MSS-PSSP460, was removed from the subtable on ATTACHMENT C titled "Service Life Exceptions for Basic-PSA Snubber," because ECP-10-0324 has changed this snubber from a Basic-PSA mechanical snubber to a Lisega hydraulic snubber. It also made the following administrative/editorial changes:</p> <p>8.8.1 Corrected typographical errors in paragraphs 3.9 and 7.8.1 and in Reference 2.1 of Table 2 (Attachment B).</p> <p>8.8.2 Added the reference to 10CFR 50.55a in Subsection 2.3, "Regulatory Bases" (a previous omission).</p> <p>8.8.3 Clarified the commitment to ASME Section XI in paragraph 2.3.3 by adding the references to IWA-2213 and IWA-4132.</p> <p>8.8.4 Updated the reference to the procedure governing site record retention in paragraph 4.1.1 and added the new NOP's 90-day requirement.</p>			

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8.8.5

Removed the requirement in Paragraph 7.1 for submitting a letter to the NRC regarding Snubber Program information.

8.8.6

Removed the reference in paragraph 7.9.7.2 to the Snubber Project Plan, because the document is no longer required.

8.8.7

Added an informational note (Note 1) to Table 8 of Attachment D regarding Particle Contamination.

8.9

Revision 8:

This revision made the following changes:

8.9.1

When Section 7.1 was eliminated in Revision 7 (see Paragraph 8.8.5 above), all the references to other sections/paragraphs listed on pages 7 through 13 and page 23 were not properly adjusted and, therefore, became out of sequenced. This revision has corrected all ten section/paragraph references.

8.9.2

Site operating experiences has shown that the Basic-PSA mechanical snubbers at Function Locations 2MSS-PSSP262A, 2MSS-PSSP262A269A and 2MSS-PSSP262A 269B should be re-lubricated more often (CR 11-90822). Therefore, this revision has changed the service life (re-lubrication frequency) for these three locations from five to four years in TABLE-7 of ATTACHMENT C.

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ATTACHMENT A Page 1 of 2 VISUAL EXAMINATION REQUIREMENTS

(Example)

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SNUBBER VISUAL EXAMINATION CHECKLIST		UNIT	PERIOD	EXAM NO.
FL NO.	MAP NO.	LOCATION		
SERIAL NO.	ISO	LINE NO.		
MODEL NO.	ELEV	HOT BAND		
TYPE	ACCESS	COLD BAND		
EXAMINATION TYPE <input type="checkbox"/> INSERVICE (Attributes 1 through 9) <input type="checkbox"/> PRESERVICE (Attributes 1 through 11) <input type="checkbox"/> NEW INSTALLATION <input type="checkbox"/> POST MAINTENANCE <input type="checkbox"/> OTHER:		EXAMINATION TECHNIQUE <input type="checkbox"/> DIRECT <input type="checkbox"/> REMOTE		VISUAL AIDS <input type="checkbox"/> 18% NEUTRAL GRAY CARD <input type="checkbox"/> FLASHLIGHT <input type="checkbox"/> BINOCULARS <input type="checkbox"/> 6" SCALE <input type="checkbox"/> OTHER:
Examination Attributes (Check box when completed, otherwise "N/A")		Anomalies (Check box only if anomaly is present)		
<input type="checkbox"/> 1. Record and/or verify snubber asset, model and serial numbers. Use Grinnell valve block no. if SN is illegible (designate as "VB").		<input type="checkbox"/> Incorrect or insufficient identification.		
<input type="checkbox"/> 2. Check the overall physical condition for damage, degradation or other impairments.		<input type="checkbox"/> Damage, deformation, disconnection or >10% corrosion of members. <input type="checkbox"/> Arc strike on the body of a mechanical snubber.		
<input type="checkbox"/> 3. Verify that the snubber pin/stud connections to the component and to the support/building structure are fully engaged and functional. For PSA trending only, inspect paddles, brackets, pins and fasteners for vibrational induced wear and document any evidence below.		<input type="checkbox"/> Missing or partially engaged load pin/stud. <input type="checkbox"/> Loose pipe clamp. <input type="checkbox"/> Loose or missing fasteners (cotter pins, retaining ring, etc.). <input type="checkbox"/> Dislodged/damaged paddle bushing (spherical bearing) <input type="checkbox"/> Missing paddle spacers. <input type="checkbox"/> Total paddle/clevis clearance > 1/4".		
<input type="checkbox"/> 4. Manually rock snubber or paddle to ensure that the paddle is free to pivot about the bushing (spherical bearing). Use a screwdriver or a similar device to induce paddle rotation, if needed.		<input type="checkbox"/> Paddle won't rock: <input type="checkbox"/> Frozen paddle bushing (spherical bearing) <input type="checkbox"/> Paddle in contact with the clevis or bracket ears.		
<input type="checkbox"/> 5. Check alignment of paddle with clamp, lugs or bracket.		<input type="checkbox"/> Paddle >5° out of alignment with the ears of the pipe clamp, welded lugs or mounting bracket		
<input type="checkbox"/> 6. Ensure that there are no physical objects that could restrict snubber thermal movement.		<input type="checkbox"/> Physical obstructions within the thermal movement threshold.		
<input type="checkbox"/> 7. Inspect sliding surfaces for conditions that may restrict movement.		<input type="checkbox"/> Wear, abrasions, corrosion or other extraneous material on sliding surfaces.		
<input type="checkbox"/> 8. Measure and record snubber/piston setting (See Instructions) _____ <input type="checkbox"/> Hot Set <input type="checkbox"/> Cold Set Avoid taking measurements during thermal transition modes.		<input type="checkbox"/> Setting is outside of appropriate operability band. System Temperature: _____ °F.		
<input type="checkbox"/> 9. Verify sufficient fluid supply of hydraulic snubbers. a.) Record reservoir level: _____. (See Instructions) b.) Look for leakage and identify leakage locations. c.) Look for puddle formation and estimate size in inches. d.) For gravity dependent reservoirs, ensure that fluid can gravitate to the snubber.		<input type="checkbox"/> Empty reservoir or sight glass <input type="checkbox"/> Leakage. Leak location: _____ <input type="checkbox"/> Puddle formation. Approx. size: _____ inches. <input type="checkbox"/> Improper orientation prohibiting fluid flow to snubber. (Reservoir lower than valve block, reservoir rotated, etc.). <input type="checkbox"/> Blocked reservoir vent. Shipping plug installed instead of vented plug or breather.		
<input type="checkbox"/> 10. For preservice only, ensure that shipping devices, such as, protective coverings, locking mechanisms or vent plugs, have been removed.		<input type="checkbox"/> Snubber installed with shipping devices.		
<input type="checkbox"/> 11. For new installations only, verify that the snubber is installed according to the design drawing or specification.		<input type="checkbox"/> Incorrect type, load rating, orientation, configuration or cold setting.		
Exam Notes/Comments:				Examiner
				Level
				Date
Assessment: <input type="checkbox"/> Acceptable <input type="checkbox"/> Unacceptable				CR
				Order
				Resolution
SEPO		Assessment Date		Date Closed

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ATTACHMENT A

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VISUAL EXAMINATION REQUIREMENTS

(Example)

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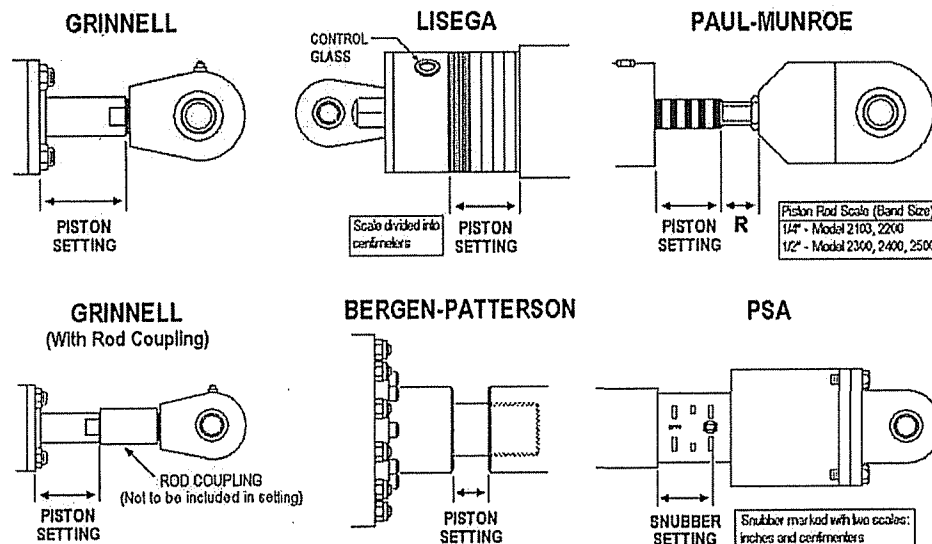
SNUBBER VISUAL EXAMINATION INSTRUCTIONS

Examination Boundaries: The examination boundaries shall include the snubber assembly from pin to pin, inclusive.

Examination Technique: The examination method will be a "direct" visual examination, that is, within 24 inches of the snubber. A remote visual examination, with or without the use of optical aids, may be performed instead of a direct examination provide all required examination attributes can be performed.

Examination Attributes: Conduct and record the examination in accordance with the Snubber Visual Examination Checklist. Perform attributes 1 through 9 for inservice examinations, attributes 1 through 10 for preservice (post-maintenance) examinations and attributes 1 through 11 for preservice (new installation) examinations. Check examination attribute boxes for step completion; otherwise, mark step "N/A". Check anomaly boxes only when the anomaly is present. Submit results to the Site Engineering Program Owner (SEPO) for review and assessment. **NOTE:** Notify the SEPO by the end of shift of any anomalies found on snubbers connected to operating systems!

Piston Setting: Measure the snubber piston position in accordance with the diagrams below. The use of scales marked on the snubber is permitted. Record whether the setting is "HOT" (system in operation) or "COLD" (system inactive) and compare it to the appropriate operability band. If bands are not provided on the checklist, then see the appropriate Snubber Plan in the Program Notebook. For remote exams of Rx side B-P's, only verify that the cold set is \geq to height of the tie rod nut (1.25").



Reservoir Level:

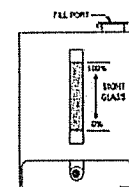
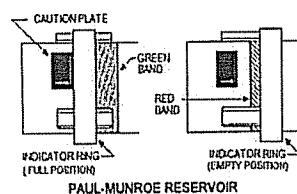
Bergen-Patterson: The fluid level is the approximate amount, expressed as a percentage of fullness, of the fluid visibly present in the sight glass of the remote reservoir. Refill (baseline) level - approximately 1/4 inch below top of sight glass.

Grinnell: The fluid level is the approximate amount, expressed as a percentage of fullness, of the fluid visibly present in an integral reservoir or the sight glass of a remote reservoir. Refill (baseline) level - approximately 80% \pm 10% of an integral reservoir or 1/4 inch below top of sight glass of a remote reservoir (about 95%).

Liseaga: The fluid level is indicated by an internal sliding brass ring that becomes distinctly visible through the control glass (see above diagram) as the fluid content decreases. The reservoir has

sufficient capacity when the brass ring is not visible, low capacity when the ring is partially visible and is empty, or nearly empty, when the ring is fully visible. Therefore, to determine fluid content peer through the control glass for the presence of the brass ring and record the reservoir fluid level as either "full", "low" or "empty", accordingly.

Paul-Munroe: Measure the width of the green or red band that is exposed by the sliding indicator ring. Only the measurement of the red band is required if any of the red is visible. Refill (baseline) level - indicator ring aligned with edge of caution plate.



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SNUBBER TESTING REQUIREMENTS

TABLE-1: Bergen-Paterson Snubber Test Requirements:

The B-P snubbers at both units are an upgraded modification of the original Unit 1 B-P snubbers. The modifications consisted of changing the rubber EPR seals with plastic Tefzel seals, the machining and chrome plating of internal surfaces for the Tefzel seals, the addition of in-place test connections and a different control valve design.

These hydraulic snubbers are velocity limiting which activate (lock-up) upon application of a load producing a specific rod velocity. After activation (lock-up) the snubber is designed to provide a release (bleed) rate to accommodate any thermal movement while restraining an uninterrupted sustained force in the same direction. However, the snubbers are equipped with lockup valves that lockup and bleed at different rates than the other unit snubbers to meet the unique piping characteristics at each unit.

Tests Required:

Activation (Lockup): The snubber activation shall be tested by verifying that the control valve closure occurs within the piston velocity range specified below when subjected to accelerated loading under tension and compression.

Release (Bleed) Rate: The piston rod velocity shall be measured at the "test load" specified below under tension and compression. The bleed rate shall fall within the specified range.

Test Method:

For installed snubbers, the valves may be removed and tested in a test block connected to an in-place test machine. Uninstalled snubbers shall be tested using either a bench test or an in-place test machine.

Test Connections:

When testing a snubber, as opposed to testing the valves in a test block, the in-place test connections shall be directly connected to the dragon shutoff valves removing and bypassing the Test-In-Place valves. (Please note that the Test-In-Place valves are not of a high pressure construction and SHALL not be used when applying test loads of greater than 500 kips.)

Test Parameters and Performance Criteria:

Piston Start Position: The as-found position for an inservice test; otherwise, 3/16" from the bottomed-out position.

Bleed Test Duration: ≤ 60 sec. Run test only long enough for the required parameters to stabilize.

Unit	Model	Max Design Load (kips)	Parameters			Criteria	
			Test Temp (°F)	Ramp Rate (in/min/sec)	Test Load (kips)	Lockup (in/min)	Bleed Rate (in/min)
1	12 x 6.25	630	70 - 100	≤ 2.0	300 – 500	Note 1	Note 2
2	12 x 6.25	500	80 - 100	≤ 2.0	100 – 500	Note 1	Note 2 & 3

Note 1: An acceptable lockup velocity (v_L) shall satisfy the following mathematical expression:

Unit 1: $0.032T - 1.24 \leq v_L \leq 0.032T + 2.68$, where T = test temperature.

Unit 2: $0.050T + 1.30 \leq v_L \leq 0.050T + 5.30$, where T = test temperature.

Note 2: An acceptable bleed rate (v_B) shall satisfy the following mathematical expression:

Unit 1: $0.163\ln(L_R) - 0.926 \leq v_B \leq 0.163\ln(L_R) - 0.676$, where (L_R) = test load in **kips**.

Unit 2: $0.00013(L_P) \leq v_B \leq 0.00013(L_P) + 0.35$, where (L_P) = test load in **psi** (Note 3).

Note 3: For conversion from *kips* to *psi* use: Area of piston face (tension side) = 93.4 in².
Area of piston face (compression) = 113.0 in².

References:

- 1.1 BVPS Calculation No. 8700-DMC-3574, "Test Correction Curves and Acceptance Criteria for Unit Bergen-Paterson Snubbers."
- 1.2 Enertech Drawing No. PC 2100, Revision B, "Control Valve."
- 1.3 Stone and Webster File No. 2503.180-44A-005A, "Installation, Operation and Maintenance Manual."
- 1.4 BVPS Calculation, No 16283.01-NM(B)-281-GA, "Upper Steam Generator Supports Rigid Strut Design," Revision 0, Add. A3.
- 1.5 Unit 2 UFSAR, Table 5.4-24, "Steam Generator Support, Snubber and Strut Embedment Loads."

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SNUBBER TESTING REQUIREMENTS

TABLE-2: Grinnell Snubber Test Requirements:

These hydraulic snubbers are velocity limiting which activate (lock-up) upon application of a load producing a specific rod velocity. After activation (lock-up) the snubber is designed to provide a release (bleed) rate to accommodate any thermal movement while restraining an uninterrupted sustained force in the same direction.

Tests Required:

Activation (Lockup): The snubber activation shall be tested by verifying that the control valve closure occurs within the piston velocity range specified below when subjected to accelerated loading under tension and compression.

Release (Bleed) Rate: The piston rod velocity shall be measured at the "test load" specified below under tension and compression. The bleed rate shall fall within the specified range.

Test Parameters and Performance Criteria:

Temperature Range: 60 – 80°F.

Ramp Rate: ≤ 2.0 in/min/sec.

Test Load: Rated Load (+0%, -10%)

Piston Start Position: As-Found position.

Bleed Test duration: ≤ 30 sec. Run test only long enough for the required parameters to stabilize.

Model	Rated Load (lbs)	Test Load Range (lbs)	As-Found Criteria		As-Left Criteria	
			Lockup (in/min)	Bleed Rate (in/min)	Lockup (in/min)	Bleed Rate (in/min)
1 ½ X 5	3,000	2,700 – 3,000	1.0 – 16.9	0.1 – 10.0	6.0 – 10.0	2.0 – 6.0
1 ½ X 10	1,100	990 - 1,100	"	"	"	"
2 ½ X 5	12,500	11,250 - 12,500	"	"	"	"
2 ½ X 10	11,000	9,900 - 11,000	"	"	"	"
3 ¼ X 5	21,000	18,900 - 21,000	"	"	"	"
3 ¼ X 10	21,000	18,900 - 21,000	"	"	"	"
4 X 5	32,000	28,800 - 32,000	"	"	"	"
4 X 10	32,000	28,800 - 32,000	"	"	"	"
5 X 5	50,000	45,000 - 50,000	"	"	"	"
5 X 10	50,000	45,000 - 50,000	"	"	"	"
6 X 5	72,000	64,800 - 72,000	"	"	"	"
8 X 5	128,000	115,200 - 128,000	"	"	"	"
8 X 10	128,000	115,200 - 128,000	"	"	"	"
10 X 5	200,000	180,000 - 200,000	"	"	1.0 – 5.0	0.5 – 1.5

References:

- 2.1 BV Calculation 8700-DMC-2194, "Grinnell Snubber Test Acceptance Criteria," Revision 0
- 2.2 ITT Grinnell Corp. Technical Report PHD 7579-S-1 (Parametric Study – Dynamic Performance), Dated 10/18/77
- 2.3 ITT Grinnell Corp. Technical Report PHD 6500-7 (Worst Case Study – Temperature Effects), Dated 1/5/79
- 2.4 ITT Grinnell Corp. Technical Report PHD 5434-1 (Filling, Purging and Calibration), Revision 11, Dated 2/22/95
- 2.5 Rick Richards of Anvil Intl. correspondence to Bob Brooks of FirstEnergy Corp., dated 10/1/07, Subject: Anvil response to snubber test questions regarding lockup velocities that are less than bleed rate velocities.

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SNUBBER TESTING REQUIREMENTS

TABLE-3: Lisega Snubber Test Requirements:

These hydraulic snubbers are velocity limiting which activate (lock-up) upon application of a load producing a specific rod velocity. After activation (lock-up) the snubber is designed to provide a release (bleed) rate for depressurizing the cylinder so the valve can unlock and for allowing thermal movement while under load.

Tests Required:

Activation (Lockup): The snubber activation shall be tested by verifying that the control valve closure occurs within the piston velocity range specified below when subjected to accelerated loading under tension and compression. The piston rod velocity shall be recorded at activation (lockup).

Release (Bleed) Rate: The piston rod velocity shall be measured at 90% to 100% of rated load under tension and compression. The bleed rate shall fall within the specified range below.

Drag (after rebuild only): Perform an initial and final drag test in both tension and compression during the as-left test following snubber rebuilding activities. Start with the piston positioned approximately 1 inch from either end. Run the test at a constant velocity of 0.5 in/min until approximately 1 inch from the end of the stroke. Repeat in the other direction. The average running drag forces shall be equal to and less than 2% of rated load.

Test Parameters and Performance Criteria:

Temperature Range:	65 – 75°F
Ramp Rate:	≤ 1.0 in/min/sec
Test Load:	Rated Load (+0%, -10%)
Lockup Start Position:	As-Found position.
Bleed Test duration:	≤ 30 sec. Run test only long enough for the required parameters to stabilize.
Drag Start Position:	≈ 0.5 in. from fully extended or retracted position.
Drag Test Velocity:	≈ 0.5 in/min.

Unit	Model	Rated Load (lbs)	Stroke (in)	Max. P – P (in)	Test Load (lbs)	Criteria		
						Lockup (in/min)	Bleed Rate (in/min)	2% Drag Limit (lbs)
1	3072	44,900	5-7/8	95.06	40410 - 44900	5.0 – 14.0	0.5 – 4.5	898
2	3018	675	3-15/16	25.63	607 – 675	“	“	13.5
2	3042	3,600	5-7/8	46.25	3240 – 3600	“	“	72
2	3062	10,000 ⁽¹⁾	5-7/8	76.75	9000 – 10000	“	“	200
2	3072	35,000 ⁽¹⁾	5-7/8	95.06	31500 – 35000	“	“	700
2	3082	53,000 ⁽¹⁾	5-7/8	94.5	47700 - 53000	“	“	1060

Note 1: Models 3062, 3072 and 3082 used at Unit 2 have a reduced load rating due to special connections needed to mate to Paul-Munroe snubber end brackets.

References:

- 3.1 Lisega Catalog “Hydraulic Shock Absorbers”, October 2001 Edition
- 3.2 Lisega Document, 30-1068, 3/25/94, “Lisega Type 30 Snubber Bleed Range vs. Temperature Curve.”
- 3.3 Lisega Document, 30-1069, 3/25/94, “Lisega Type 30 Snubber Lock-up Range vs. Temperature Curve”
- 3.4 Lisega Procedure No., TP-9001, Revision 1, “Test Procedure for Functional Testing of Lisega Series 30 Hydraulic Snubber”

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SNUBBER TESTING REQUIREMENTS

TABLE-4: Paul-Munroe Snubber Test Requirements:

These hydraulic snubbers are velocity limiting which activate upon application of any cyclic load with a frequency of 1 Hz or greater. Instead of a poppet style control valve that locks and shuts off flow through the valve, these Paul-Munroe snubbers utilize a fixed orifice drilled through the piston that limits flow between the two sides of the cylinder. The orifice permits fluid flow and piston movement in either direction under normal thermal growth conditions, but restricts the increased flow rate caused by dynamic loading. These snubbers are also equipped with a double-ended piston rod creating an equal sided cylinder.

Tests Required:

Release (Bleed) Rate: The piston rod velocity shall be measured at 90% to 100% of N/U rated load under tension and compression. This test is performed to verify the proper restraining action (activation and bleed rate) of the snubber internal orifice valve. The piston velocity shall fall within the specified range below. Note: temperature has no effect on bleed rate at N/U or faulted loads because of the orifice design (Reference 4.4).

Test Parameters and Performance Criteria:

Temperature Range: 60 – 80°F.
 Ramp Rate: ≤ 2.0 in/min/sec.
 Test Load: Normal & Upset Rated Load (+0%, -10%)
 Piston Start Position: ≈ 0.5 in. from fully extended or retracted position.
 Bleed Test duration: ≤ 30 sec. Run test only long enough for the required parameters to stabilize.

Model	N/U Rated Load (lbs)	Stroke (in)	Max. P - P (in)	Test Load (lbs)	Criteria
					Bleed Rate (in/min)
2103	1,700	5.0	30	1,530 - 1,700	6.0 – 30.0
2200	10,000	5.0	30	9,000 - 10,000	“
2300	35,000	5.0	40	31,500 - 35,000	“
2400	53,000	5.0	40	47,700 - 53,000	“
2500	105,000	5.0	40	94,500 - 105,000	“

Snubbers with extensions shall be tested at a reduced test load according to the table below.

Model	Reduced N/U Rated Load (lbs) per Maximum Extended Pin to Pin Dimension.						
	40 in.	50 in.	60 in.	70 in.	80 in.	90 in.	100 in.
2103	1,100	800	700	450	300		
2200	8,000	7,200	6,200	5,500	4,800	4,200	3,600
2300	35,000	35,000	34,000	34,000	27,000	27,000	21,000
2400	53,000	53,000	53,000	53,000	53,000	53,000	44,000
2500	105,000	105,000	105,000	105,000	104,000	104,000	90,000

References:

- Stone and Webster File No., 2659.950-000-007B, Paul-Munroe Functional Test Procedure, PA 87493, Revision E, “PMH 2300 Pipe Snubber.”
- Stone and Webster File No., 2659.950-000-010B, Paul-Munroe Functional Test Procedure, PA 87755, Revision C, “PMH 2400 Pipe Snubber.”
- Stone and Webster File No., 2659.950-000-011B, Paul-Munroe Functional Test Procedure, PA 86685, Revision D, “PMH 2500 Pipe Snubber.”
- Paul-Munroe Letter from Mr. Kenneth A. Stanley to Mr. Arthur J. Oster of the Stone and Webster Engineering Corp., dated 10/26/81. “PMH Hydraulic Pipe Snubber Bleed Rates,” (attached to Calculation No. 12241-NP(B)-296-ZB).
- Nuclear Engineering Specification, 10080-DMS-0077, Rev. 4, “Functional Test Requirements and Acceptance Criteria for BV-2 Snubbers”.

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SNUBBER TESTING REQUIREMENTS

TABLE-5: PSA Snubber Test Requirements:

These mechanical snubbers are acceleration limiting which function so as to place an upper limit on the acceleration, in either direction, of the component to which is attached. A minimum acceleration limit is also provided to assure relatively free movement under thermal operating conditions.

Tests Required:

- Drag** Measurements shall be made of the initial and final drag friction forces in both tension and compression. The average drag forces shall be equal to or less than 5% of rated load.
- Activation** The snubber acceleration shall be recorded while the snubber is loaded between 40% and 95% of its rated load in tension and compression. The recorded acceleration shall be within the range specified below. Care shall be exercised so as not to bottom the snubber out during testing

Test Parameters and Performance Criteria:

- Temperature Range: 60 – 80°F.
- Acceleration Test Load: 40% to 95% of Rated Load
- Snubber Start Position: ≈ 0.5 in. from fully extended or retracted position.

Model	Stroke (in)	Rated Load (lbs)	Max. P – P (in)	Max. Drag Test Velocity (in/min)	Criteria		Test Load (lbs)	Criteria
					2% Rated Load (lbs)	5% Rated Load (lbs)		Acceleration Limit (g's)
PSA-1/4	4	350	66	4.7	7	17.5	140 – 333	0.001 – 0.020
PSA-1/2	2.5	650	66	“	13	33	260 – 618	“
PSA-1	4	1,500	64	“	30	75	600 – 1425	“
PSA-1L	8	1,487	61	“	30	74	595 – 1413	“
PSA-3	5	6,000	54	“	120	300	2400 - 5700	“
PSA-3L	10	6,000	54	“	120	300	2400 - 5700	“
PSA-10	6	15,000	55	“	300	750	6000 - 14250	“
PSA-10L	12	14,400	55	“	288	720	5760 – 13680	“
PSA-35	6	50,000	120	2.35	1,000	2,500	20000 – 47500	“
PSA-100	6	120,000	120	“	2,400	6,000	48000 - 114000	“

Drag Test Assessment:

Drag test results equaling 5% of the rated load or less are considered acceptable indicating that the snubber is functioning as designed. However, drag test results in excess of 2% of the rated load indicate that some internal degradation is present. Therefore, snubbers with drag forces exceeding 2% of the rated load shall be disassembled, inspected, and trended in accordance with Section 7.9.6. They shall also be refurbished and meet the 2% test criteria prior to returning to service.

References:

- 5.1 Nuclear Engineering Specification, 10080-DMS-0077, Rev. 4, "Functional Test Requirements and Acceptance Criteria for BV-2 Snubbers"
- 5.2 Basic-PSA Specification, DR 1319, "Mechanical Shock Arrestors Standard Design Specification," Revision 2, Dated 8/13/04.
- 5.3 Basic-PSA Specification, DR 3020, "Mechanical Shock Arrestors Service Life Extension Program," Revision 1, Dated 8/3/05.

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SNUBBER TESTING REQUIREMENTS

TABLE-6: Failure Mode Grouping and Additional Testing Requirements:

Failure Mode Groups (FMG): Snubbers found unacceptable by inservice testing shall be evaluated for cause. The results of the evaluation shall be used to assign the unacceptable snubbers and all snubbers generically susceptible to the same failure to one or more of the Failure Mode Groups (FMG) defined below.

Application-induced failure	Failures resulting from environmental conditions or improper application of the snubber.
Design or manufacturing failure	Failures resulting from potential defects in manufacturing or design. This includes failures of any snubber that fails to withstand the environment or application for which it was designed.
Maintenance, repair or installation failure	Failures resulting from damage during maintenance, repair or installation activities.
Transient dynamic event failure	Failures resulting from water or steam hammer.
Isolated failure	A failure which does not cause other snubbers to be suspect.
Unexplained failure	Failures that cannot be classified into any of the above FMG categories.

Additional Testing: Test failures may require additional testing depending on the FMG category and the extent of corrective action. For each snubber found unacceptable through inservice testing one additional sample of snubbers shall be selected and tested according to the table below. Except for unexplained and isolated failures, additional snubbers shall be selected randomly from the untested snubbers in the FMG. For unexplained failures, the selection shall be from the DTPG, and the additional sample shall consist of the snubbers that meet the requirements of Note 1 below. The size of any additional sample will be 10% of the DTPG or FMG (whichever is larger) rounded up to the next integer. Testing is completed when all the snubbers in an additional sample test satisfactory or all snubbers in the DTPG or FMG are tested.

FMG Category	Additional Testing	Sample Source
Application-induced failure	Not required if all FMG snubbers are replaced or modified OR if all unacceptable snubbers in the FMG are replaced or repaired and the environment or application is made compatible; otherwise required.	FMG
Design or manufacturing failure	Not required if all FMG snubbers are replaced or modified; otherwise required.	FMG
Maintenance, repair or installation failure	Required	FMG
Transient dynamic event failure	Stroke or test 100% of FMG	FMG
Isolated failure	Not required	N/A
Unexplained failure	Required	DTPG (Note 1)

Note 1: As practical, the additional sample from the DTPG shall include the following:

- Snubbers of the same manufacturing design.
- Snubbers immediately adjacent to the unacceptable snubbers.
- Snubbers from the same piping system.
- Snubbers from the similar piping systems.
- Snubbers that are previously untested.

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SNUBBER SERVICE LIFE MONITORING

TABLE-7: Snubber Service Life:

Snubber Design	Limiting Attribute	Shelf Life (Years)	Service Life (years)	Service Life Baseline	Reference
Basic-PSA	Grease: NRRG-2 or NRRG-159	20	(Note 1)	Snubber Assembly Date	7.2, 7.3, 7.4
Bergen-Paterson	Seals: Tefzel 280	40 (Note 2)	40	Snubber Assembly Date (Note 3)	7.10, 7.15
	Fluid : SF1154	20 (Note 4)	Per TABLE 8	Snubber Assembly Date	7.10
	ECP-07-0153 O-ring: EPR/EPDM	10 (Note 5)	16	O-ring Installation Date	7.13
Grinnell	Seals: EPR/EPDM	10 (Note 5)	16 (Note 6)	Snubber Assembly Date	7.5
	Fluid : SF1154/SF-N	20/5 (Note 4)	25	Snubber Assembly Date	7.1, 7.14, 7.17
Lisega	Seals: Viton	TBD	23	(Note 7)	7.6, 7.7
	Fluid : AK-350	TBD	40	Snubber Assembly Date	7.8, 7.14
Paul-Munroe	Seals: Tefzel 280	40 (Note 2)	(Note 8)	Unit 2 Startup Date (8/14/87)	7.9, 7.11, 7.12
	Fluid : SF1154	20 (Note 4)	(Note 8)	Fluid Fill Date	7.11, 7.12, 7.14

Note 1: All Basic-PSA snubbers installed on the Main Steam System shall be re-greased every 10 years. All other Basic-PSA snubbers (not installed on the Main Steam System) shall be re-greased every 15 years. Exceptions to this rule are noted below.

Note 2: The shelf life for replacement Tefzel 280 seals shall be factored into the snubber's service life.

Note 3: The baseline date for the Unit 2 Bergen-Paterson snubbers shall initially be the Unit 2 Startup date (8/14/87) and the seal installation date, thereafter.

Note 4: New SF1154 fluid shall have a shelf life of 20 years. SF1154 can be used after 20 years provided it meets the sampling requirements of TABLE 8 (ATTACHMENT D), but not to exceed 40 years. Used SF1154 may be used in BOP Grinnell snubbers provided it meets the sampling requirements of TABLE 8 (ATTACHMENT D). New SF-N fluid shall have a shelf life of 5 years. SF-N fluid that has exceeded it self or service life is to be discarded.

Note 5: The service life for seals made of ethylene propylene rubber (EPR/EPDM) begins when the seals are installed and compressed, since this places the seal in an energized and stressed state. Therefore, the shelf life for EPR/EPDM seals shall not be factored into the snubber's service life.

Note 6: Unit 1 BOP snubbers SHP-HSS-227, 233, 234, and 237 should be refurbished every 10 years with 236 every 6 years. Special attention should be given to 236. Historically, 236 has exhibited the worst wear of all Unit 1 snubbers.

Note 7: The baseline date for Lisega snubbers shall be the snubber's initial installation date and the seal installation date, thereafter.

Note 8: All Paul-Munroe snubber seals are made of Tefzel material with a 40 year seal life, with the exception of the reservoir fill valve seal (ethylene propylene - 10 years life) and the bleed-drain plug seals (stainless steel). However, because of the internal wear and leakage problem that has been identified with Unit 2 Paul-Munroe snubbers, the general plan is to eliminate instead of refurbishing these snubbers. Therefore, when a Paul-Munroe snubber can no longer hold sufficient fluid for an extended period of time, then the snubber should be replaced with a Lisega snubber in accordance with ECP 04-00040 (TER 7931). However, for those Paul-Munroe snubbers that have not developed signs of the internal wear problem after twenty years of operation, then consideration should be given for replacing the fluid sometimes between 20 and 25 years for those snubbers selected to be maintained for the duration of their 40-year service life.

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SNUBBER SERVICE LIFE MONITORING

TABLE-7: Snubber Service Life (Continued)

Service Life Exceptions for Basic-PSA Snubbers

Service Life	Functional Location	Service Life	Functional Location	Service Life	Functional Location
4 years	2MSS-PSSP262A	6 years	2MSS-PSSP006	8 years	2MSS-PSSP103
	2MSS-PSSP269A		2MSS-PSSP111A	18 years	2BDG-PSSP325Y
	2MSS-PSSP269B		2MSS-PSSP111B		2BDG-PSSP326Y
5 years	2MSS-PSSP151A		2MSS-PSSP131A		2BDG-PSSP327Y
	2MSS-PSSP196A		2MSS-PSSP131B		2BDG-PSSP440A
	2MSS-PSSP196B		2MSS-PSSP132A		2BDG-PSSP440B
12 years	2FWR-PSSP124Y		2MSS-PSSP132B		2BDG-PSSP441A
	2FWR-PSSP127Y		2MSS-PSSP150A		2BDG-PSSP441B
	2FWS-PSSP139Y		2MSS-PSSP150B		2BDG-PSSP442YA
	2HDH-PSSP073A		2MSS-PSSP151B		2BDG-PSSP442YB
	2HDH-PSSP073B		2MSS-PSSP200A		2BDG-PSSP445YA
	2HDH-PSSP076A		2MSS-PSSP200B		2BDG-PSSP445YB
	2HDH-PSSP076B		2MSS-PSSP262B		2DGS-PSSP027YA
	2RCS-PSSP892A		2MSS-PSSP270A		2DGS-PSSP027YB
	2SWS-PSSP830Y		2MSS-PSSP270B		

References:

- 7.1 Anvil International Report PE-04-40-3, "Sequential Radiation and Life Testing of Anvil International Suppressors," Revision 0, Dated 1/11/05
- 7.2 Basic-PSA Specification, DR 1319, "Mechanical Shock Arrestors Standard Design Specification," Revision 2, Dated 8/13/04.
- 7.3 Basic-PSA Specification, DR 3020, "Mechanical Shock Arrestors Service Life Extension Program," Revision 1, Dated 8/3/05.
- 7.4 Condition Report, CR 00-3236 (Corrective Action, CA 00-3236-1)
- 7.5 Lake Engineering Co. Report No. LEC-776-R1, Revision 0, dated 5/8/03, "Seal Life of Grinnell Snubber at Beaver Valley Power Station, Unit 1"
- 7.6 Lisega IOM Manual, File No. 2512.001-000-001
- 7.7 EER Notification 600600020, Lisega Snubber Seal Life Extension."
- 7.8 Lisega Test Report No. QSPB002/2004, "Testing of Snubber Function before and after Gamma Radiation," Dated 5/31/05.
- 7.9 Nuclear Engineering Technical Evaluation Reports, TER 6724 and TER 7931 (ECP 04-0040), "The Replacement of Paul-Munroe Hydraulic Snubbers with Lisega Snubbers"
- 7.10 Paul-Munroe IOM Manual for Modified Bergen-Paterson Snubbers, File No. 2503.180-044A-005.
- 7.11 Paul-Munroe IOM Manual for Pipe Snubbers, Model Nos. PMH-2300 through PMH-2500, File No. 2512.000-000-001.
- 7.12 Paul-Munroe IOM Manual for Pipe Snubbers, Model Nos. PMH-2101 through PMH-2500, File No. 2559.950-000-001B
- 7.13 ECP-07-0153, "Snubber RC-HC-10C Packing Material Installation."
- 7.14 Notification 600411330, "BV Response to OE18999 - Radiation Qualification of Lisega Snubber Hydraulic Fluid (AK 350)", dated 9/7/07.
- 7.15 Enertech Letter to FENOC, from Ira J. Silverman to Bob Brooks, dated 3/3/06, "Justification for extended service life for Tefzel Boss Seal."
- 7.16 Self-Assessment, BV-SA-08-093, "The Effectiveness of the Current Maintenance Strategy for PSA Mechanical Snubbers at BV," Dated 12/30/08.
- 7.17 Anvil International Product Information, PI 08-02, "Snubber Fluid," Dated 10/30/08.
- 7.18 ECP-10-0324, "Reinstall Snubber 2MSS-PSSP460 for Design Margin Improvement."

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SNUBBER FLUID MONITORING

TABLE-8: SF1154 Fluid Quality Requirements:

Replacement SF1154 fluid for Bergen-Paterson (B-P) and Paul-Munroe (PMH) snubbers must be certified to Level A fluid quality requirements identified below.

To qualify for continued use, fluid samples from Bergen-Paterson snubbers, remote reservoirs and from fluid in storage shall meet the following requirements:

Sampling Requirements:

Sample Source	Sample Frequency	Minimum Sample Size	Fluid Quality Level
Snubber cylinder (B-P)	10 Years	100 ml	B
Remote reservoir (B-P)	10 Years	100 ml	B
Remote reservoir (Grinnell)	25 Years	20 ml	B
Storage container (Unused fluid > 20 year shelf life)	10 Years	100 ml for every 5 gallons	A (B-P & PMH) B (Grinnell)
Storage container (Used fluid)	10 Years	100 ml for every 5 gallons	B

Fluid Quality Requirements:

Attributes	Fluid Quality Level A	Fluid Quality Level B
Water Content	≤ 100 parts per million	≤ 150 parts per million
Particle Contamination (Note 1)	\leq NAS 1638, Class 6	\leq NAS 1638, Class 9
Viscosity at $77^{\circ} \pm 2^{\circ}\text{F}$ ($25^{\circ} \pm 1^{\circ}\text{C}$)	150 – 200 centistokes	150 – 200 centistokes
Evidence of Coagulation	None	None

Sample results from a particular snubber or reservoir may be used to represent the fluid quality for other snubbers or reservoirs of the same design located in the same or less severe environments and using fluid of similar age.

Fluid that has exceeded the above quality level criteria is not indicative of imminent snubber failure. Therefore, fluid that has exceeded the water and viscosity criteria by 10%, or less, or has a particulate content corresponding to a NAS 1638 Class 10 may continue to be used provided there is no evidence of internal degradation or a decline in snubber performance. Fluid that has exceeded the water and viscosity criteria by more than 10% or has a NAS 1638 Class greater than 10 shall not be used or shall be replaced at the first opportunity.

Note 1: The particle count should be obtained manually, as opposed to, using a laser. Laser counts may erroneously include air bubbles as particulate.

References:

- 8.1 Paul-Munroe IOM Manual for Modified Bergen-Paterson Snubbers, File No. 2503.180-044A-005.
- 8.2 Paul-Munroe IOM Manual for Pipe Snubbers, Model Nos. PMH-2101 through PMH-2500, File No. 2559.950-000-001B
- 8.3 Ken Hamilton of Enertech (Curtiss Wright) correspondence with Bob Brooks of FirstEnergy Corp, dated 2/21/08, Subject: Snubber Fluid Viscosity.
- 8.4 Ken Hamilton of Enertech (Curtiss Wright) correspondence with Bob Brooks of FirstEnergy Corp, dated 3/14/08, Subject: Snubber Fluid Viscosity.